REMARKS/ARGUMENTS

Reconsideration of this application is respectfully requested.

Initially, the Examiner's attention is drawn to the fact that the Form PTO/SB/08a filed with applicants' IDS on October 30, 2006, has not yet been fully initialed. In particular, as shown by the attached copy of the document returned with the office action dated June 29, 2007, there are no initials yet in place to signify consideration of the earlier submitted EPO Search Report dated September 25, 2006. Return of a fully initialed copy of this Form PTO/SB/08a is respectfully requested.

In response to the rejection of claim 18 under 35 U.S.C. §112, second paragraph, this claim has been amended so as to avoid the alleged lack of antecedent basis – thus mooting this ground of rejection.

In response to the rejection of claims 1-16 under 35 U.S.C. §101 as allegedly directed to non-statutory subject matter, both independent claims 1 and 13 have been amended above so as to more explicitly be directed to an apparatus (i.e., "machine"). As the Examiner will appreciate, even prior to amendment, the claims were not directed merely to "software" *per se*. Instead, the claims are clearly directed to <u>apparatus</u> that has been configured so as to constitute structure (i.e., "means for…") capable of performing the stated functions. Inasmuch as "means-plus-function" claim elements are clearly

permitted under 35 U.S.C. §112, 6^{th} paragraph, these claims have always been directed to statutory subject matter in compliance with all statutes and regulations. As the Federal Circuit and other courts have long held, even a general purpose computer that has been programmed with a novel and non-obvious program so as to perform concrete, tangible and useful results is, in fact, a new "machine." A computer program embodied in such computing apparatus does not exist merely in metaphysical thought processes. Instead, a computer program that is capable of being executed by a central processing unit (CPU) of a computing system must be physically embodied in a physical medium so as to be capable of being read to generate suitable digital signals for input to an instruction register of the CPU, for example. Such program memory structure and/or a computer attached to such program storage media is clearly a physical machine just as much as any other electronic apparatus. The fact that the electrical (or optical) signals being processed involve the circuits of a computer system does not make such claimed subject matter "non-statutory."

In any event, claim 1 now specifically recites a computer and memory associated therewith, etc. Claim 13 requires a digital store and includes means functioning with a computer to output a calculated value representing a physical quantity, etc. Accordingly, this ground of rejection is now believed to have been overcome.

Thus, all outstanding formality-based issues are now believed to have been resolved in the applicants' favor.

With respect to prior art bases for rejection, it is noted that the Examiner has failed to set forth any ground of rejection for claims 5, 6, 7, 9 and 18. Accordingly, it is assumed that the Examiner agrees that claims 5, 6, 7, 9 and 18 are directed to novel and non-obvious subject matter.

The rejection of claims 1-4, 8, 11, 13-14 and 17 under 35 U.S.C. §103 as allegedly being made "obvious" based on Hinds '331 in view of the "admitted prior art" is respectfully traversed.

As explained in more detail below, the above claim amendments clarify a basic advantage of the present invention, whereby both the calculation of an interpolation coefficient and execution of the corresponding interpolation calculation (to obtain an output value from the map data) are accurately performed by operating on floating-point representation values, although at least one of the set of map points and the set of map values are stored as fixed-point representation data.

In addition, amended claim 1 incorporates limitations from now cancelled claims 2, 5 and 6 (which are cancelled without prejudice or disclaimer), while amended claim 17 incorporates limitations from cancelled claims 3 and 8 (also cancelled without prejudice

or disclaimer). Claim 4 has also been cancelled since there is now no independent claim from which it can depend. However, the function set out in original claim 4 can be achieved by combining the functions of claims 1 and 17. As noted above, there is no outstanding rejection of original claims 5, 6, 7, 9 or 18. Thus, it is believed that the Examiner will readily agree that at least claims including one or more of such limitations are now in immediately allowable condition.

In addition to incorporating features of now cancelled claims, claim 1 has been amended to be more specifically set out the interpolation function performed by an exemplary embodiment. Concerning claim 17, please note that support for that claim as amended is found at page 31 of the specification (i.e., in which the map points are expressed in fixed-point representation and the map values in floating-point representation, in the stored memory map data). The operation set out in amended claim 17 can readily be inferred from such described embodiment.

Independent claim 13 requires, *inter alia*, that at least one set of the stored map points/map values are stored as fixed-point representation data – in combination with means for outputting a calculated value representing a physical quantity, including a stored least significant bit conversion value that is expressed in floating-point representation and represents a physical quantity value that has been predetermined as corresponding to a least significant bit of the fixed-point representation data.

The Examiner alleges that virtually all of this can be found in Hinds at paragraphs 104-109 in conjunction with Figs. 5 and 8. That is, the Examiner only admits that Hinds fails to disclose that the data is map data that comprises a set of map points and a set of map values respectively corresponding to said map points and said at least one of said set of map points and set of map values indirectly represent respective values of a physical quantity. For this admitted deficiency, the Examiner relies upon the "admitted prior art." However, as will be explained in more detail below, Hinds has additional deficiencies that have not yet apparently been appreciated by the Examiner.

Consider when a set of memory map data (generally referred to simply as map data) are stored in a computer memory as a set of map points and a set of map values as described in the present application (e.g., as illustrated in Figs. 2A, 2B). If each of the stored map points and map values are expressed in floating-point representation, an output value corresponding to a specific input value can be obtained from the map data to a high degree of accuracy (e.g., if one performs an interpolation calculation). For example, referring again to Figs. 2A, 2B in which the map points are respective voltage values and the map values are respective fuel amounts, it may be required to use the map data to obtain the amount of fuel corresponding to an input value of 0.55 (V). Clearly, the required fuel amount will be between the map values 60.0 and 58.0 (L), since the input value of 0.55 (V) lies between the map points 0.5 and 0.65 (V). Thus it is

necessary to perform an interpolation between map values, to obtain the corresponding fuel quantity. To perform the interpolation, it is first necessary to determine the interpolation coefficient, by a calculation based on comparing the input value of 0.55 (V) with the nearest map points (0.5 and 0.65).

If both the map values and map points are expressed in floating-point representation, then both the calculation of the interpolation coefficient (using the map points and the input value) and also the interpolation calculation (using the interpolation coefficient and map values) can be performed to a high degree of accuracy. However, if one or both of the set of map points and the set of map values are stored in fixed-point representation (in order to reduce the amount of memory capacity required), then prior to applicants' invention, it has not been possible to readily achieve such high accuracy.

Specifically, two cases can be considered, i.e., case 1, in which the map points are expressed in floating-point representation and the map values in fixed-point representation (as with the described embodiment of the present invention), and case 2, in which the map points are expressed in fixed-point representation and the map values in floating-point representation.

With the described exemplary embodiment and as set out in amended claim 1, for case 1, the apparatus can operate as follows. When an input value (e.g., voltage value) is supplied for obtaining a corresponding output value (value of a physical quantity, e.g.,

fuel amount) from the map data, a floating-point calculation is performed to obtain the requisite interpolation coefficient, based on the input value and the two map points that are closest to the input value. The determination of that adjacent pair of map points is illustrated in Figs. 5 and 6 (step 2131) of the drawings, and the calculation of the interpolation coefficient is illustrated in Fig. 6 (step 2132).

In addition, the two map values respectively corresponding to these two map points are obtained from the map data (Fig. 7, steps 2310, 2320). These two map values are then converted to floating-point representation (step 2330), and an interpolation calculation is performed on these, using the aforementioned interpolation coefficient (steps 2340, 2350 in Fig. 7). The result (i.e., a floating-point representation value) is then multiplied by a LSB conversion value (step 2500 in Fig. 4B). The LSB conversion value is a floating-point value which expresses a specific amount of a physical quantity (e.g., specific amount of fuel) that corresponds to the LSB of the map value data.

In that way, the required output value (physical quantity amount) is obtained, by a floating-point interpolation calculation, to the same degree of accuracy as if the map values had been held stored in memory in floating-point representation. That is to say, both the calculation for obtaining the interpolation coefficient, and the calculation for actually performing the interpolation, are each executed on floating-point representation

numbers. However, the amount of memory capacity required for the map data can be substantially reduced.

It will be apparent that such a concept is not described or implied in any of the cited prior art references. Indeed, see the previously submitted claims 5 and 6 which were not rejected on any prior art basis and whose limitations are now incorporated into amended claim 1.

Amended claim 17 can be considered for case 2 above (i.e., map points stored in fixed-point representation and map values stored in fixed-point representation). Here, the apparatus can operate as follows. When an input value of a first physical quantity (e.g., voltage value) is supplied for obtaining a corresponding output value of a second physical quantity from the map data, the map points are first converted to respective floating-point representation values. Each of these is then multiplied by a LSB conversion value, to be converted to respective values of the first physical quantity (e.g., voltage values). In this case, the LSB conversion value is a floating-point value which expresses a specific amount of the first physical quantity (e.g., voltage) that corresponds to the LSB of the map point data.

A pair of these converted physical quantity values (i.e., each of which corresponds to a specific map value) are then selected, which are closest to the inputted (first physical quantity) value. The interpolation coefficient corresponding to that pair of first physical

quantity values is then calculated. The pair of map values (i.e., pair of values of the second physical quantity, expressed in floating-point representation) respectively corresponding to that pair of values of the first physical quantity are then obtained from the map data.

The interpolation coefficient is then used in a calculation to interpolate between that pair of map values, to thereby obtain the required output value (required value of the second physical quantity, e.g., fuel amount).

In that way, as for case 1 above, both the calculation for obtaining the interpolation coefficient, and the calculation for actually performing the interpolation, are each executed on floating-point representation numbers, although only the map values are stored in floating-point representation. Thus, the same advantages are obtained as described for case 1. As described in the specification (page 31, lines 21-25), such a configuration (case 2) is especially advantageous when the map values are required to cover a wide range.

Here again, it will be apparent that such a concept is not described or implied in any of the cited prior art references.

Claims 1 and 17 (respectively corresponding to case 1 and case 2 described above) have been amended to better express the above discussed features.

As mentioned above, the Examiner has not stated any reasons for rejecting claims 5 and 6. Hinds was cited against claims 1-4, 8, 11, 13-14, 17, but Hinds certainly does not disclose the features set out in these claims and discussed above.

Hinds is believed to be less relevant to the applicants' invention than other prior art of record. Hind is concerned only with the general field of techniques for conversion between floating-point and fixed-point representation.

Although previously amended claims 3 and 8 have been rejected based on Hinds, the now amended claim 17 (which incorporates the limitations of now cancelled claims 3 and 8) is not made obvious by Hinds (e.g., see the above discussion).

Amended claims 1 and 17 provide a novel advantage in that when an output value is to be derived from a stored set of map data in response to an inputted value, where at least one of the set of map points and the set of map values of the map data are stored in fixed-point representation, and a necessary interpolation calculation is performed to obtain the required output value, both that interpolation calculation and also the calculation of an interpolation coefficient (which is required for performing the interpolation calculation) <u>can each be executed upon floating-point representation numbers</u>. Hence, high accuracy of calculation can be achieved, while yet also enabling the amount of data that must be stored as the map data to be minimized. Such a concept is not described in the admitted prior art or in any of the cited prior art references.

The rejection of claims 10, 12 and 15-16 under 35 U.S.C. §103 as allegedly being made "obvious" based on Hinds/admitted prior art in further view of Ford '698 is also respectfully traversed.

Fundamental deficiencies of Hinds have already been noted above with respect to at least one parent claim of these rejected claims. Ford does not supply those deficiencies. Accordingly, it is not believed necessary at this time to discuss the additional deficiencies of this allegedly "obvious" three-way combination of references with respect to the additional features recited in these rejected claims.

Accordingly, this entire application is now believed to be in allowable form and a formal notice to that effect is respectfully solicited.

Respectfully submitted,

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